Mobile AC Climate Protection Partnership Meeting

9 December 2008

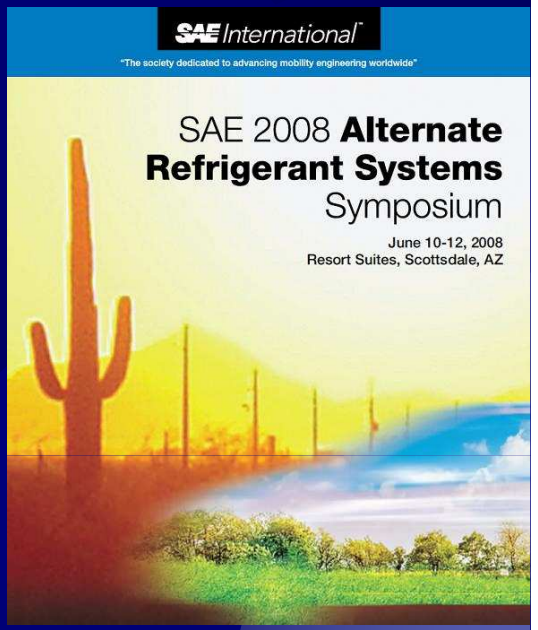
JW Marriott Hotel

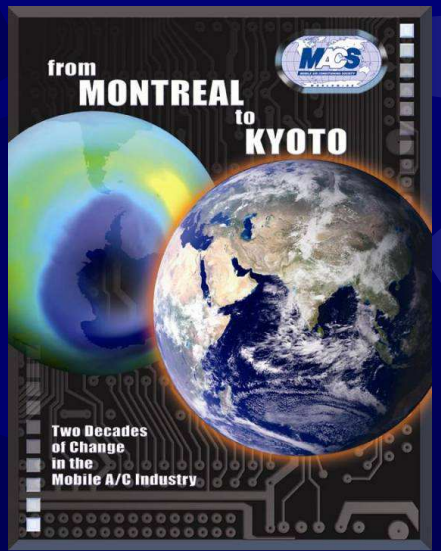
Washington, DC

Ward Atkinson

Interior Climate Control Standards Committee Activities

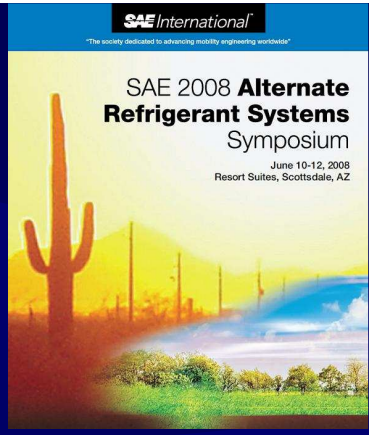
- Phoenix Alternate Refrigerant Symposiums
- Cooperative Research Programs
- International MAC Summits



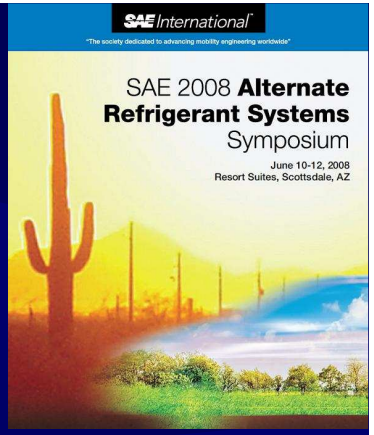


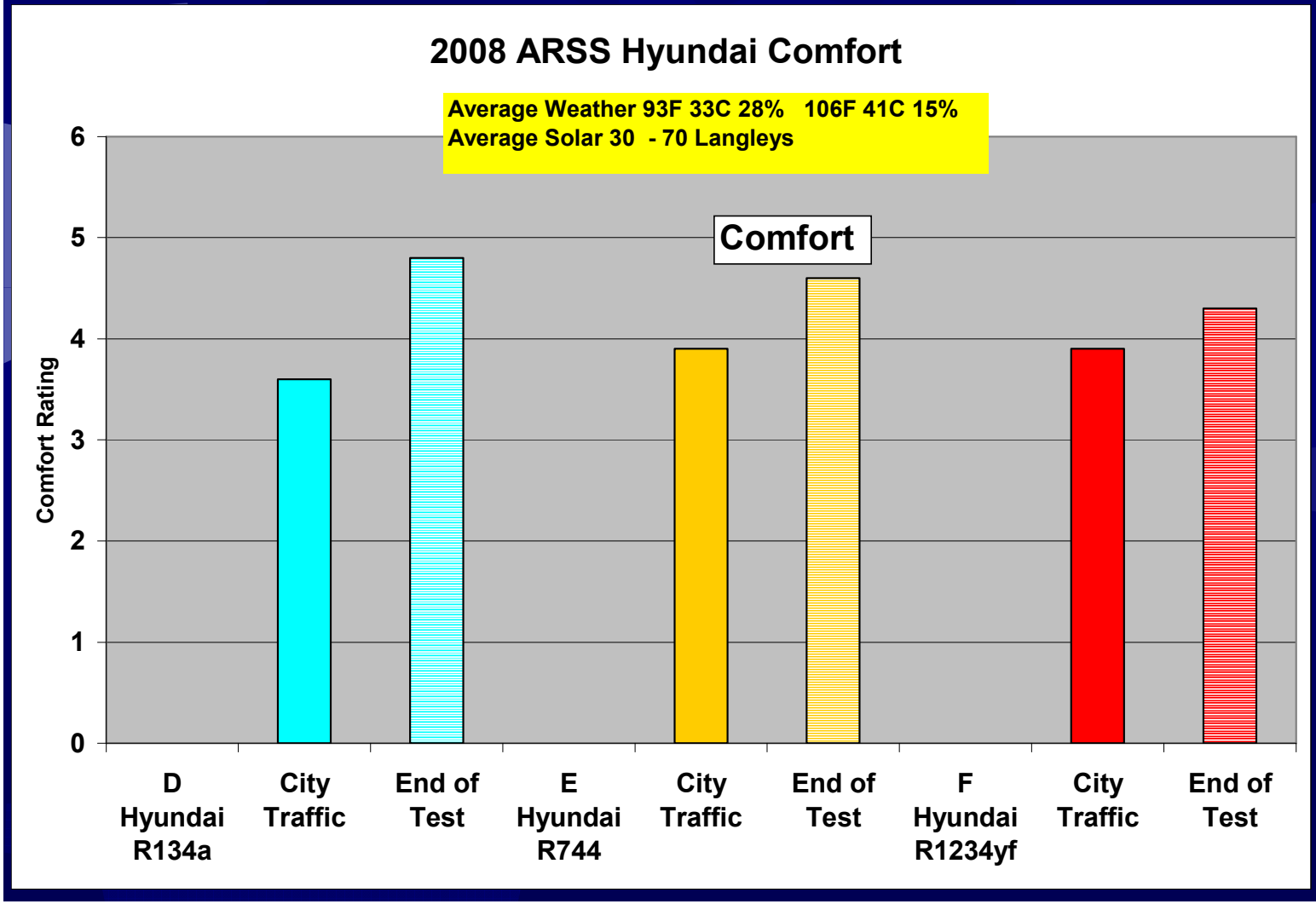
1998 Alternate Refrigerant Phoenix Meeting

2008 Alternate Refrigerant Phoenix Meeting

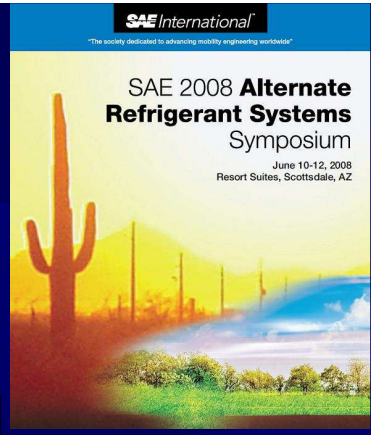


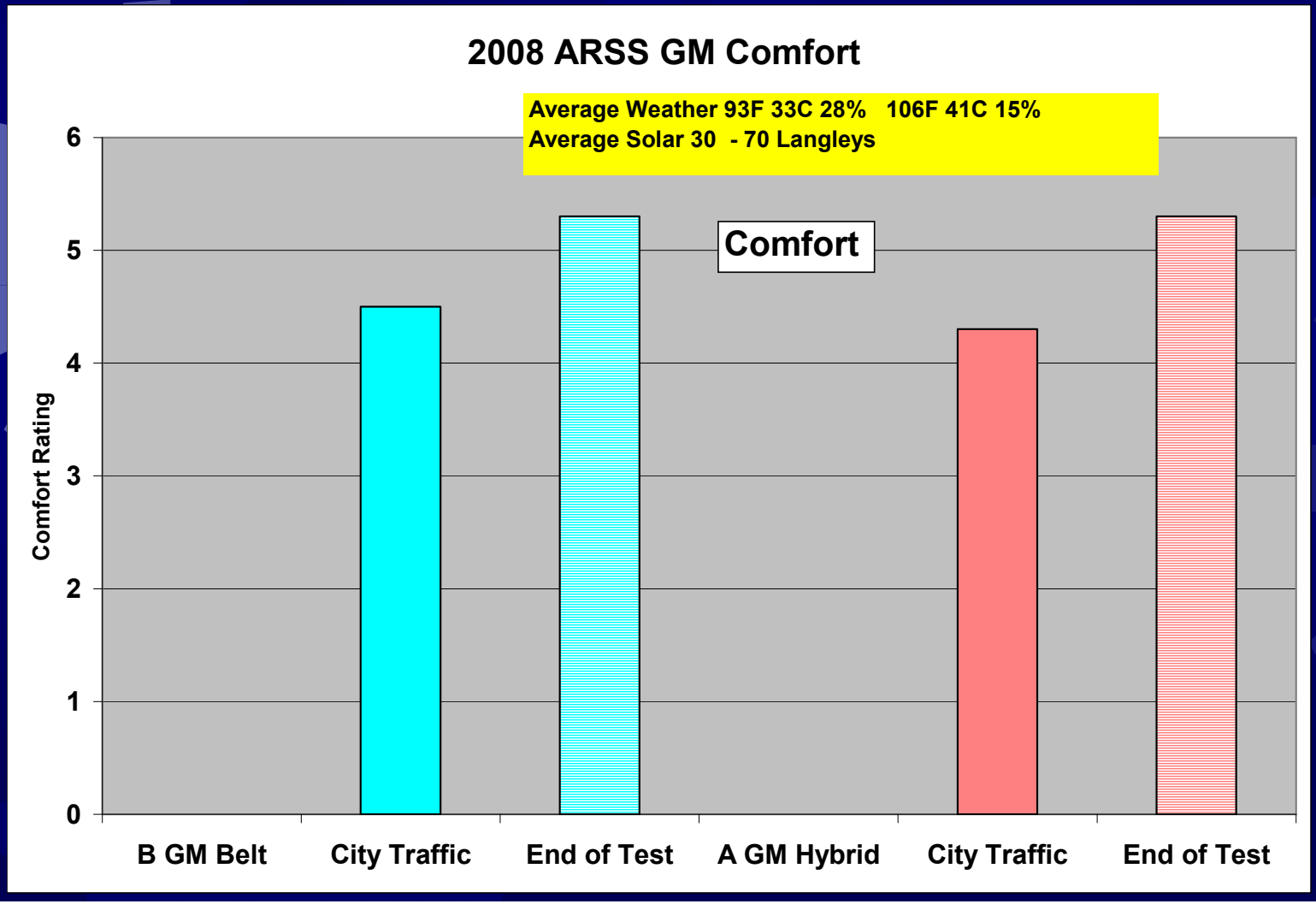
2008 Alternate Refrigerant Phoenix Meeting





2008 Alternate Refrigerant Phoenix Meeting





SAE Cooperative Research Programs

R744

SAE Cooperative Research Program

- Alternate Refrigerant Study [ARCRP I & II]
  - System Efficiency and Performance
    - Fixed and Variable Compressors
    - Different Expansion Devices
    - Optimized Heat Exchangers
  - Risk Assessment by U.S. Army RDECOM
    - Support from SAE ICCC team

R152a
SAE Cooperative Research Program

Alternate Refrigerant Study [ARCRP II]

- Direct Expansion System Efficiency and Performance evaluation
  - Same components as R134a system, not optimized for R152a
- Risk Assessment by U.S. Army RDECOM
  - Support from SAE ICCC team

SAE International

R134a
SAE IMAC Cooperative Research Program

- System Efficiency and Performance Optimization
  - Improved Heat Exchangers, Compressors, Controls
    - Reduced Energy Requirements [Indirect Emissions]
- Reduced Refrigerant Leakage
  - Reduced Refrigerant Direct Emissions
- Improved Service Sector
  - Developed New Service Equipment Standards
    - Improved Refrigerant Recovery at Service
      - Reduced Refrigerant Emissions

GAR Blends
SAE CRP150 Cooperative Research Programs

Global Alternate Refrigerants - Blends

- Dupont DP –1
- Honeywell Fluid H
- Ineos Fluor AC-1
- Solvay

- System Efficiency and Performance Evaluations
- Material Compatibility
- Risk Assessments
- Preliminary Service Impact Assessment

HFO1234yf SAE 1234 Cooperative Research Programs

- System Efficiency and Performance Evaluation
- Material Compatibility and Refrigerant Leakage Evaluations
- Safety and Risk Assessment

HFO1234yf
SAE 1234 Cooperative Research Programs

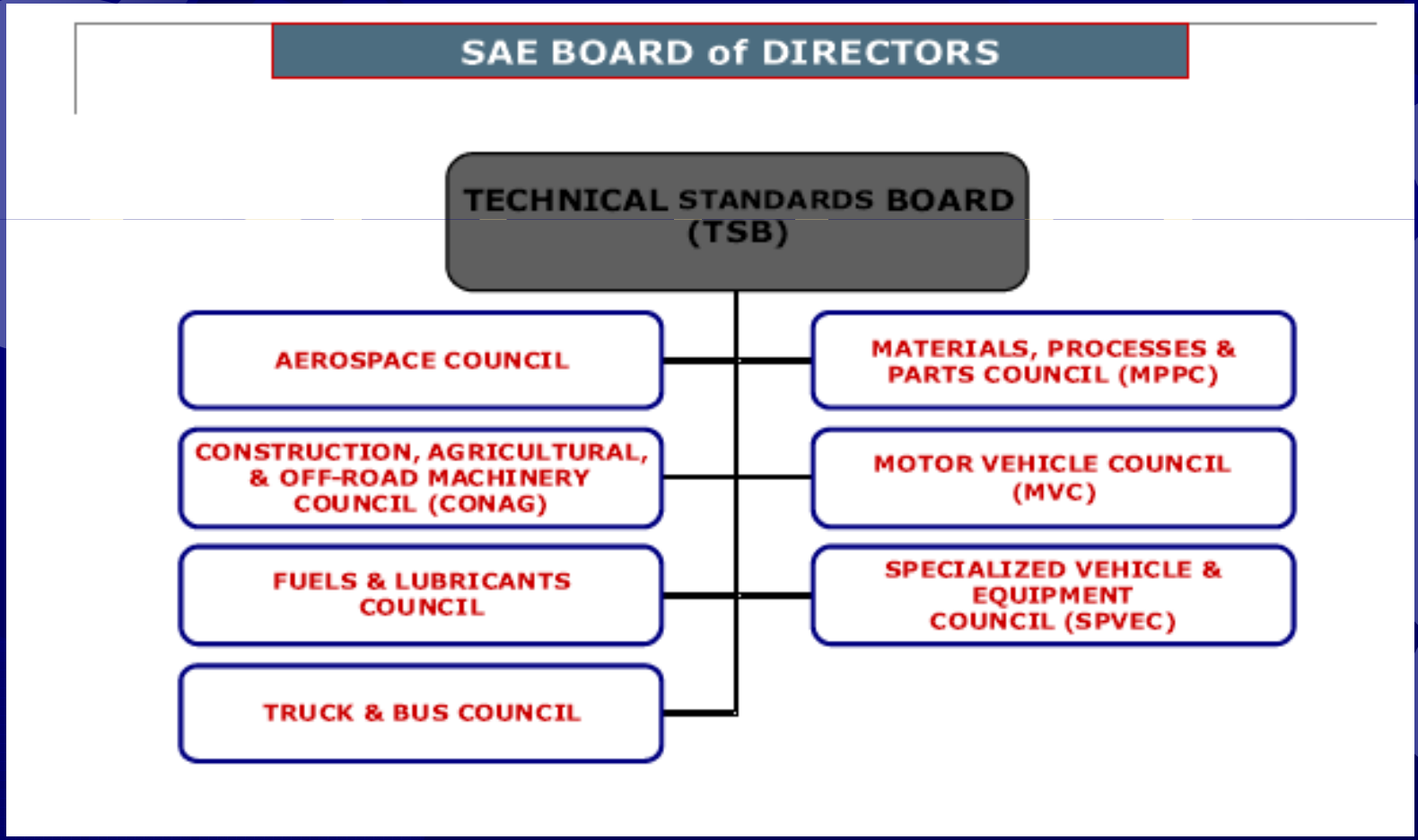
- This alternative refrigerant -- of all proposed alternatives under consideration -- has been judged to offer significant environmental benefits
- Posing no significant safety concerns and offering the greatest potential to meet environmental and consumer needs
- Research conducted by seven international Independent Research organizations has not identified any significant risks for use of this refrigerant in Mobile Air Conditioning systems
- Results of The Cooperative Research Program 1234 can be found on the SAE Web site
  http://www.sae.org/standardsdev/tsb/cooperative/altrefrig.htm

SAE ICCC
[Interior Climate Control Committee]

Current status of Standard Development

SAE International

TECHNICAL STANDARDS BOARD



Interior Climate Control Standards Committee

MOTOR VEHICLE COUNCIL (MVC)

ICC Voting Members

- Vehicle OEM/Tier one Suppliers
- A/C System and equipment Suppliers
- Chemical Industry

Interior Climate Control Standards Committee

ICC Working Groups

Industry Experts

Develop Document

Interior Climate Control Standards Committee

SAE Standards and Recommended Practices that are globally recognized for:

- Heating- A/C System Design
- A/C System Service Equipment
- Technician Service Procedures

SAE Standards and Recommended Practices that are referenced in:

- U.S. Clean Air Act
- U.S. Motor Vehicle Safety Standards
- Some state laws
- Some ISO standards

Interior Climate Control Standards Committee

SAE Mobile A/C Standards and Recommended Practices

- Over 30 Currently Published Documents
- Over 24 New/Revised Documents Under Development

- SAE Committees are open to all parties having expertise and willing to help develop SAE Documents

SAE ICCC
[Interior Climate Control Committee]

Has developed new or revised SAE standards to assure that refrigerants are applied to mobile air conditioning systems in a safe manner and established service equipment and technician training and certification requirements

SAE Standards

- System Design
  - Service Equipment
  - Technician Requirements
- Refrigerants
  - R134a
  - R152a
  - R744
  - HFO1234yf

Design Requirements				
Standard	R134a	R152a	R744	R1234yf
Safety Standards for Motor Vehicle Refrigerant Vapor Compression Systems	J639	Modify J639	J639	Modify J639
Refrigerant Purity and Container Requirements for Refrigerant Used in Mobile Air-Conditioning Systems	J2776	New	J2683 being modified	J2844 New Document
Measurement of Passenger Compartment Refrigerant Concentrations under A/C system refrigerant leakage conditions	New or modify J2772	Modify J2772	J2772 Being Modified	Modify J2772
Refrigerant Guidelines for Safety and Risk Analysis for use in Mobile Air Conditioning Systems	NA	Modify J2773	J2773	Modify J2773
Service Equipment Requirements				
Standard	R134a	R152a	R744	R1234yf
ULTRAVIOLET LEAK DETECTION: Preformance Requirements For Fluorescent Refrigerant Leak Detection Dye Injection Equipment for Service of Mobile A/C systems	J2299	New or Modify J2299	New or Modify J2299	New or Modify J2299
Refrigerant Recovery- Recycle - Charging Equipment for Mobile Automotive Air Conditioning Systems	J2788	New or modify J2788	J2771	J2843
Refrigerant Recovery Only Equipment for Mobile Automotive Air Conditioning Systems	J2810	New or modify J2810	Not required	J2851
Refrigerant Minimum Performance Criteria for Electronic Leak Detectors	J2791 Published	New or modify J2791	J2774	New or modify J2791
Refrigerant Recovery Equipment for Mobile Automotive Air Conditioning Systems	J2810	New or modify J2810	Not required	New or modify J2810
R744 [CO2] Service Hose, Fittings and Couplers for Mobile Refrigerant Systems Service Equipment			J2769	
Technician Requirements				
Standard	R134a	R152a	R744	R1234yf
Technician Certification for Servicing and Refrigerant Containment of A/C Systems	J2845	J2845	J2845	J2845

SAE Standards

8 SAE Standards Addressing R744

R744 SAE Standards	
Safety Standards for Motor Vehicle Refrigerant Vapor Compression Systems	J639
Service Standards for Mobile Air Conditioning Systems	J2770
Measurement of Passenger Compartment Refrigerant Concentrations under A/C system refrigerant leakage conditions	J2772
Refrigerant Guidelines for Safety and Risk Analysis for use in Mobile Air Conditioning Systems	J2773
Evaporator Design Certification for OEM and service replacement	J2842
Refrigerant Recovery -Charging Equipment for Mobile Automotive Air Conditioning Systems	J2771
Refrigerant Purity and Container Requirements for Refrigerant Used in Mobile Air-Conditioning Systems	J2683
Technician Certification for Servicing and Refrigerant Containment of A/C Systems	J2845

SAE Standards

9 SAE Standards

Addressing HFO1234yf

HFO1234yf SAE Standards	
Safety Standards for Motor Vehicle Refrigerant Vapor Compression Systems	J639
Service Standards for Mobile Air Conditioning Systems	J2770
Measurement of Passenger Compartment Refrigerant Concentrations under A/C system refrigerant leakage conditions	J2772
Refrigerant Guidelines for Safety and Risk Analysis for use in Mobile Air Conditioning Systems	J2773
Evaporator Design Certification for OEM and service replacement	J2842
Refrigerant Recovery- Recycle-Charging Equipment for Mobile Automotive Air Conditioning Systems	J2843
Refrigerant Purity and Container Requirements for Refrigerant Used in Mobile Air-Conditioning Systems	J2844
Technician Certification for Servicing and Refrigerant Containment of A/C Systems	J2845
Refrigerant Recovery Only Equipment for Mobile Automotive Air Conditioning Systems	J2851

International Standards

SAE ICCC are working with the ISO Technical Committee 22, Working Group 14 to develop a new ISO 817standard for mobile air conditioning safety

Refrigerant Standards

American Society of Heating, Refrigerating and Air-Conditioning Engineers Inc

The Air-Conditioning, Heating, and Refrigeration Institute (AHRI)

COMPRESSED GAS ASSOCIATION

SAE J639 and ASHRAE 34

- SAE J639 is currently being revised and states:
  - "meet appropriate system design standards and regulatory requirements and non-explosive as defined in the American Society of Heating, Refrigeration, and Air Conditioning Engineers, Inc., Standard ANSI/ASHRAE 34."

SAE J639 and ASHRAE 34

- Current ASHRAE 34 is not specific regarding R744 on issues that may affect human exposure, even though carbon dioxide is considered by some to be toxic, it is not by this standard. The definition of “toxic” is also not standardized amongst regulatory and standards groups

- SNAP potential regulatory requirements when using R744 in mobile A/C systems will limit occupant exposure to 3% for 15 minutes

SAE J639 and ASHRAE 34

- ASHRAE has established an Ad Hoc Committee to work with SAE ICCC activity

Refrigerant Container Issues

Does not list all designations that are required for the containers to be incompliance with all Federal regulations

Refrigerant Type	Container Construction	Container Size	Container color/marking	Container Fitting	Requires Pressure Relief Device	Container Classification	SAE J Doc's
R134a	Non-reusable	30/lb 13.6kg	PMS 2975 Sky Blue	½" ACME	No	DOT Title 49CFR	J639 J2776 J2196 J2197
R744 No Odorant		Ref. 4 Requires two sizes	Ref. 3	Ref. 1 Ref. 2	Yes		J639 J2683 J2769
R744 With Odorant		Ref. 4 Requires two sizes	Ref. 3	Ref. 1 Ref. 2	Yes		J639 J2683 J2769
HFO1234yf		30/lb 13.6kg		Ref. 1	No		J639 J2844
HFC-152a		30/lb 13.6kg		Ref. 1	No		J639

Ref 1 Use SAE Service low side quick-couple fitting on container
Ref 2 Proposal European container fitting Valve Outlet Connection (ISO-5145 2004 Number 11)
To minimize the potential of carbon dioxide refrigerant that contains an odorant and residual oil from being accidentally connected to other uses, such as food and beverage applications, a unique container fitting shall be provided on all containers. SAE and European car manufacturers will cooperate with CGA and EIGA to get a globally accepted ISO container fitting. (ISO-5145 2004 Number 11)
Ref. 3 Proposed by SAE Working Group container color light green gray (PMS 352) – With odorant bright green shoulder (PMS 352)
Ref. 4 Service container shall hold 10 kg of R744 refrigerant. Since the service equipment container is small there is a requirement for a larger container to supply the service facility. The R744 re-fill container size color and fitting should use the same colors and fittings as established for the 10 kg service equipment container.

Refrigerant Container Issues

R744 [Potential for 4 containers]

- **The R744 container sizes are important since service equipment size and the technical issues in refilling containers in the service equipment (system charge amounts) is a problem when using larger R744 containers and the ultimate storage of these containers in the workspace must be addressed for safety issues**
- **This results in the need for two different containers, small for mounting in the service equipment (10kg) and a larger on-site container for re-charging the small cylinder**
- **Due to safety concerns, R744 containing an odorant, will require additional containers having a different set of unique fittings**
- **Unique service hose fittings for service equipment have been proposed**

Refrigerant Container Issues

HFO1234yf

- Only one container with a unique fitting for HFO1234yf is required
- Unique service hose fittings for service equipment need to be established

HFC-152a

- There will be a requirement for only one container with a unique fitting for HFC-152a
- Unique service hose fittings for service equipment need to be established

Refrigerant Container Issues

- R152a and HFO1234yf are within the scope of ARI 700
  - HFO1234yf will likely be added to ARI 700 during the next revision cycle, and we will likely publish it before the end of 2009
  - R152a is already in the current version of ARI 700
- R744 is not covered under the scope of ARI 700 at the moment

Refrigerant Container Issues

- ARI Guideline N for cylinder colors is currently under revision
  - Committee revising this guideline has not decided yet on whether to adopt a new system, or to try and improve the existing system
- Odorant (R744), ARI 700 has never addressed this issue

Regulatory Issues

R744 – HFO1234yf

- Required Technician Certification To Service MAC Systems
- Refrigerant Containers
  - Returnable
  - Non-reusable
    - Must be returned to recover refrigerant – salvage metal
      - No containers to land fills
- No Retrofitting of HFC134a MACS with HFO1234yf or Other Refrigerants
- No EPA Approval of Replacement Refrigerants For HFC134a - HFO1234yf - R744 MACS